

REMARKS

Claims 1-4, 6, 8-51, 53-57 and 59 are pending. Claims 1-4, 6, 8-51, 53-57 and 59 are rejected. Claims 1, 8, 14, 15 and 35 are amended. This Response is filed in reply to the Final Office Action dated November 2, 2005.

Amendments to the claims are not an acquiescence to any of the rejections. Furthermore, silence with regard to any of the Examiner's rejections is not an acquiescence to such rejections. Specifically, silence with regard to Examiner's rejection of a dependent claim, when such claim depends from an independent claim that Applicants consider allowable for reasons provided herein, is not an acquiescence to such rejection of the dependent claim(s), but rather a recognition by Applicants that such previously lodged rejection is moot based on Applicants' remarks and/or amendments relative to the independent claims (that Applicants consider allowable) from which the dependent claim(s) depends. Applicants reserve the option to further prosecute the same or similar claims in the instant or a subsequent application. Upon entry of the Amendment, claims 1-4, 6, 8-51, 53-57 and 59 are pending in the present application.

With respect to the Final Office Action dated November 2, 2005, the Examiner objected to claims 16 and 18 under 37 C.F.R. §1.75(c) as being of improper dependent form for failing to further limit the subject matter of a previous claim. The Examiner contended that claim 8 recites an "SBUV image providing means comprising a photocathode for receiving the optical radiation on the UV spectral range only...", and that claims 16 and 18 recite "the SBUV image sensor...". Claim 8 is amended to recite an "SBUV image sensor" and claims 14 and 15 are amended to recite further limitations of "the SBUV image sensor". Applicants respectfully request reconsideration of the claims.

With respect to the rejections of the claims, the Examiner rejected claims 1, 3, 6, 8-18, 20, 22, 35, 38-43, 46, 47, 54-56 and 59 under 35 U.S.C. §103(a) as being unpatentable over Willey (U.S. 5,841,574) in view of Dirscherl et al. (U.S. 5,001,348). The Examiner rejected claims 2, 19 and 24 under 35 U.S.C. §103(a) as being unpatentable over Willey in view of Dirscherl et al. and further in view of Filopovich (U.S. 5,079,416). The Examiner

rejected claims 4, 21, 23, 28-34, 36, 37, 48-51, 53 and 57 under 35 U.S.C. §103(a) as being unpatentable over Willey in view of Dirscherl et al. and further in view of Applicants' admitted prior art. The Examiner rejected claims 25 and 26 under 35 U.S.C. §103(a) as being unpatentable over Willey in view of Dirscherl et al. and Filopovich and further in view of Baril et al. (U.S. 5,535,053). The Examiner rejected claim 27 under 35 U.S.C. §103(a) as being unpatentable over Willey and Dirscherl et al. and further in view of Palmer (U.S. 5,687,034). Claims 44 and 45 were rejected under 35 U.S.C. §103(a) as being unpatentable over Willey and Dirscherl et al. and further in view of Hartemann et al. (U.S. 4,835,391). Applicants traverse the Examiner's rejections under 35 U.S.C. §103(a), and respectfully request reconsideration in view of the amendments and remarks.

Claim 1, as amended, recites "*combining in real time the images as obtained by said simultaneous imaging through a common aperture and in a common optical axis, by overlaying in real time a first image obtained from said first imaging unit over a second image obtained from said second imaging unit thereby forming one combined and exactly registered visual image showing in real time the UV emittance in its exact position within background scenery of the scene and with no parallax.*" Claims 8, and 35 are similarly amended to recite real time combining. Accordingly, independent claims 1, 8 and 35 have now been amended to clearly indicate that the apparatus of the present invention is targeted to a real time detection, location and visualization of a UV emittance in daylight (or equivalent indoor) illumination.

The Examiner contends that Willey "...suggests the combining of the images as obtained by said simultaneous imaging...". The Examiner refers to col. 6, lines 11-19, where Willey indicates "*the present invention is capable of collecting the imagery to be used for sensor **fusion** which occurs between the two optical detectors over the field of view which is common to both detectors (i.e., in both spectral bands) as long as both detectors are scanning the same scene. The common field of view over which sensor **fusion** is achieved may be adjusted by changing the focal length of one optical path relative to the other by, for example, changing the magnification of the MWIR or LWIR relay lens*". Willey mentions "fusion" only twice more throughout his patent, i.e., in col. 13, last line, saying "... thus indicating that both the visible E-O and IR systems would be suitable for use in

mapping and sensor fusion applications", and in col. 17, lines 42-45, saying "...Distortion of the present inventive system (see Table 3 for one representative embodiment) is low, implying that this system is suitable for mapping applications as well as visible/IR sensor fusion".

From a clear reading of these quotations, it can be realized that the fusion is more of a goal of Willey, than a real teaching how to obtain this goal. Throughout Willey's patent, neither in the drawings (including the cited Fig. 4 which is a conceptual description of the system), nor in Willey's set of claims is the issue of fusion indicated or mentioned. By just mentioning such a goal in the description, and without providing any teaching, support, or enabling, Willey's patent cannot negate the inventiveness of the present invention, even when combined with Dirscherl, which obviously at all lacks this fusion feature.

The present invention not only clearly shows how the combination is made, it also shows how to provide it on line and in real time, and the application also provides clear results of experiments which have been made (see for example Figs. 6C, Fig. 7, Fig. 8B, Figs. 9B, and Figs 10A and their related text pages 40-43), which clearly show how corona having a very weak UV illumination or other UV sources such as a UV mercury lamp, alcohol and hydrogen flames, and a distant fire can be detected, located, and visualized in daytime and in real time. Now, assuming *arguendo* that Willey teaches fusion by mentioning this goal, though Applicants firmly state that the Willey disclosure does not provide such a teaching, the mere brief mentioning in Willey of a fusion cannot and should not be interpreted as an indication or teaching for the "*combining in real time ...*", as recited in claim 1. As mentioned many times throughout the Willey patent (see also Willey's claim 1), Willey's invention is mainly targeted to an aerial reconnaissance camera. Those of skill in the art of airborne reconnaissance systems such as of Willey (see, for example, abstract line 2, and background art col. 1 lines 28+, col. 2, lines 54+, etc.), know that such a system accumulates a mass amount of image data, and stores the accumulated data in a mass storage for further future processing. Willey also implies that this is the case by stating in col. 6 line 11 that his system "*.... is capable of collecting the imagery to be used for sensor fusion...*". Not only does Willey never use the term "real time", he also does not provide any teaching for the manner of how his fusion is performed. To those of skill in the art it is absolutely

clear that Willey's system cannot at all display any multi-spectral view of any type (and obviously not of UV emission with IR or visible scenery in daylight) in real time, even when combined with the SBUV sensor of Dirscherl et al.

Moreover, and as is known in the art, in an aerial reconnaissance camera the image of the scene moves rapidly across the sensor because of the forward motion of the aircraft or the panoramic scanning perpendicular to the motion. This enables the camera to acquire images of a large area in a short time. However, in aerial reconnaissance systems these acquired images are always recorded for later processing. This is because examination of the image to look for information ("Image Intelligence" or IMINT) can only be carried out on a stationary image. Moreover, the fact that Willey's system is designed mainly for aerial reconnaissance, forces an extremely short period during which the sensor samples each ground scene. Therefore, any attempt to make the reconnaissance system of Willey to operate in real-time will be useless, in view of the extremely high rate of collecting images of rapidly changing ground sceneries.

Furthermore, if the camera records images in two or more wavelength bands simultaneously, the ground sampled distance (GSD) in the two or more images is not normally the same (for example visible and infra-red detectors, the infrared having typically larger pixels and a larger GSD than the visible channel, and the difference is even much larger when IR and UV detectors are used), and conversion of one image to match the GSD of the other and registration of the images is necessary before image fusion can be implemented. This cannot be done in real time. Indeed, Willey refers mainly to a linear sensor array (see in the background of the invention column 1, line 12). These are mainly used in aerial reconnaissance and remote sensing systems where the image of the scene moves rapidly across the sensor to enable acquiring images of large areas in short time. Also in the description of the preferred embodiment Willey describes linear sensors "...*In the preferred embodiment, the visible and near IR detector 29 is preferably a linear electro-optical detector and is oriented perpendicular to the XZ plane. Similarly the MWIR or LWIR detector 50 is preferably also a linear electro-optical detector and is oriented perpendicular to the XZ plane...*" (column 9, line 38 to line 45), and "*Note that in Figs. 9 and 11 the detectors 29 and 50 are linear devices with their long axis perpendicular to the plane of the*

page" (Column 10 line 13 to 15). Similar references to linear sensor array detectors and limited area array devices can be found also in other places within Willey's patent and claims. Therefore, it is clear from the above that the concept of multi-spectral fusion in aerial reconnaissance of Willey system teaches away from real time operation, and a hypothetical transfer of such system to real time requires a very substantial effort and teaching, that obviously has not been provided in Willey's patent. Therefore, there is no way but to conclude that Willey's patent which essentially entirely refers to aerial reconnaissance does not include or suggest any real-time operation.

The characteristics of the present invention; i.e., the displaying of a UV image and the visible (or IR) scenery with exact registration and with no parallax in real time, provide a solution to a long felt need in many applications, some of which, like corona detection, are disclosed in the application. In this respect, the Applicant comments that any invention involves at least two stages. A first stage is the noticing of a problem, and a second stage is the providing of a solution to the problem. In the present case, it can be seen that neither Willey nor Dirscherl at all mention the above-described long-felt need, and therefore they do not and cannot satisfy this need, even when combined. In some aspects both Willey and Dirscherl teach away from the present invention.

Willey teaches away from the present invention by referring to long range detection systems "*A multi-spectral decentered catadioptric-type optical system suitable for use with long range oblique aerial reconnaissance camera systems, spectrum analyzers, astronomical imagers, remote sensing, and other applications is described*" (abstract lines 1-4). In a spectrum analyzer, the data from various bands is collected and analyzed and presented as a spectrum of each pixel. In an astronomical imager, images are collected over long periods of time to achieve the necessary sensitivity. In remote sensing, as in aerial reconnaissance, push-broom or panoramic scanning is used to cover large areas, and the collected data is stored for later analysis. None of these are suitable for real-time data fusion. The "*other applications*" are not defined, and lacking any indication to the contrary, and in accordance with the applications described in Willey patent which relate to long range aerial reconnaissance detection systems, this term is to be interpreted in a same manner to non-real time systems. All the applications mentioned in the invention and in the

claims relate to aerial reconnaissance and astronomical imaging systems. In the background of the invention column 5 line 1-9 Willey says "*In sum, the optical system of the present invention addresses the problems normally associated with conventional centrally obscured Cassegrain or other Catadioptric type lenses previously proposed for long focal length aerial reconnaissance applications*".

The apparatus of Willey does not and cannot at all enable the detecting, locating and visualizing by imaging of a UV source in daylight. If a solar blind sensor such as the one described by Dirscherl would have been introduced in Willey's system, no real time viewing of a UV source in the background of a visible and IR scene in daylight could be possible, nor real time imaging of the UV source in the visible or IR scene in daylight is possible. Moreover many times throughout his patent and claims, Willey indicates that he relates to a **broad** electromagnetic spectrum viewing (see, for example, claims 1, 10, 17, 25, 30 and 35). For example, just in claim 1 of Willey, a reference to the term "broad portion of the electromagnetic spectrum" appears 6 times. As mentioned in the application, and as is well known to those skilled in the art, a broad spectrum channel does not, and cannot enable viewing of a UV image in daylight, as a solar blind channel requires using a very narrow spectral band.

In the response to the previous Office Actions, Applicants explained in much detail why the system of Dirscherl et al. cannot display simultaneously a UV image of a weak source and a visible image in daylight. For the sake of brevity, Applicants will not repeat all said technical explanations here, and will just refer the Examiner to said explanations. In short, Dirscherl et al. discloses a system which has two modes of operation. In the first mode, the system of Dirscherl et al., using a wide band photocathode, is a multi-spectral system; i.e., UV, IR, and visible. In that case, the UV image can be acquired only in the dark and not in daylight (unless the UV source is of extremely high intensity). In the second mode, when the system of Dirscherl et al. uses a UV photocathode, it can display a UV image in daylight. However, no display of the visible view or of the IR image can be obtained simultaneously with the UV image. Therefore, is the system of Dirscherl et al. a multi-spectral one that includes the SBUV range? Yes, but only when operating in the first mode (dark operation). Does it enable view of a SBUV image of a weak source in daylight?

Yes, but only in the second mode, and without the visible background scenery. Does it provide registration of the UV image within the visible background scenery? In daylight absolutely not, as no visual background scenery is acquired or can be acquired simultaneously with the UV image. However, even in the dark when visible and UV (or UV and IR) images are acquired in Dirscherl et al., what does Dirscherl et al. do with said UV and IR images? He displays them on two separate displays (see Dirscherl et al. Fig. 7), or separated one from the other on a same display, as shown in Dirscherl et al. Fig. 12. In this respect Dirscherl et al. clearly teaches away from the invention.

Therefore, when both of the publications of Dirscherl et al. and Willey teach away from the invention, each in its own way, there is no motivation for one of skill in the art to combine said publications. Even ignoring such leading away from the invention by Willey and Dirscherl et al., if one of skill in the art succeeded in combining the Willey system and the Dirscherl et al. solar blind UV sensor, the solution will still obviously lack the very essential issue of real-time combination as stated above. By lacking the essential feature of real time fusion, even the combination of solar blind UV sensor of Dirscherl et al. and the Willey system will never allow the possibility of viewing detecting and locating UV emissions in real time, such as corona which appears on high voltage equipment. By including the unique combination as disclosed in amended claims 1, 8, and 35, the present invention opened the way for many new capabilities that have not been possible, and were never suggested by the prior art. Both Willey and Dirscherl et al. have never even considered solving the problems that the present invention solves, which lead to an apparatus which enables a real time viewing in daylight of an image of the UV source overlaid and with exact registration on the image of the scenery and with no parallax. Lacking even one of said requirements does not at all enable the achieving of the goals of the present invention. Therefore, Applicants believe that to argue that the independent claims 1, 8, and 35 of the present invention are obvious in view of the combination of Dirscherl et al. and Willey is to argue with hindsight.

In support of these observations and in accordance with 37 C.F.R. §1.132, Applicants attach and submit an affidavit by Mr. Jeremy M. Topaz dated February 23, 2006, including a Curriculum Vitae for Mr. Topaz. The Examiner contended that the previously

supplied affidavit did not refer to the individual claims of the application. The present affidavit clearly shows that the objective evidence of non-obviousness is commensurate in scope with the claims.


In view of the above remarks and the attached affidavit, Applicants submit that claims 1, 8, and 35 of the present invention are allowable. At the least, the amendments place the claims in better form for appeal, should an appeal be required. Accordingly, Applicants respectfully request entry of the amendments and allowance of claims 1, 8 and 35. Claims 2-4, 6, 9-34, 36-51, 53-57 and 59, depend either directly or indirectly from respective claims 1, 8 and 35 and are allowable at least by dependency.

CONCLUSION

Based on the above amendments and remarks, it is respectfully submitted that the claims and thus this application are in condition for allowance. Accordingly, allowance is requested. If there are any remaining issues or the Examiner believes that a telephone conversation with Applicants' attorney would be helpful in expediting the prosecution of this application, the Examiner is invited to call the undersigned at (617) 832-1175.

Respectfully submitted,

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